Technical
Information
TI 127F/00/en

Capacitance Limit Detection
nivotester FTC 420/421/422

Limit switches in Minipac design for liquids and bulk solids

Application
Nivotester FTC 420...422 capacitive limit switches can be used for a variety of purposes, e.g., for:

- overspill protection,
- inventory monitoring,
- interface layer detection,
- pump protection,
- constant level monitoring and
- material flow optimisation.

When used with a suitable probe, the Nivotester allows level detection:

- in aggressive materials,
- at high pressures or in vacuum,
- at high or low temperatures,
- in coarse- or fine- grained bulk goods,
- in high or low viscosity liquids,
- in materials with a tendency to form deposits at the probe.

- ❑ Nivotester FTC 420: basic version
- ❑ Nivotester FTC 421: with adjustable switching delay
- ❑ Nivotester FTC 422: with adjustable switching differential for two-point control

Features
- Proven 3-wire cabling technique gives interference-free transmission from probe to limit switch.
- Calibration from switch cabinet or control room.
- Operates in minimum or maximum level failsafe mode.
- Operational status of unit and level switch indicated by LEDs on front panel.
- Potential-free change-over contact allows connection of alarms, relays, contactors, solenoid valves etc..
- Removable terminal blocks for quick connection.

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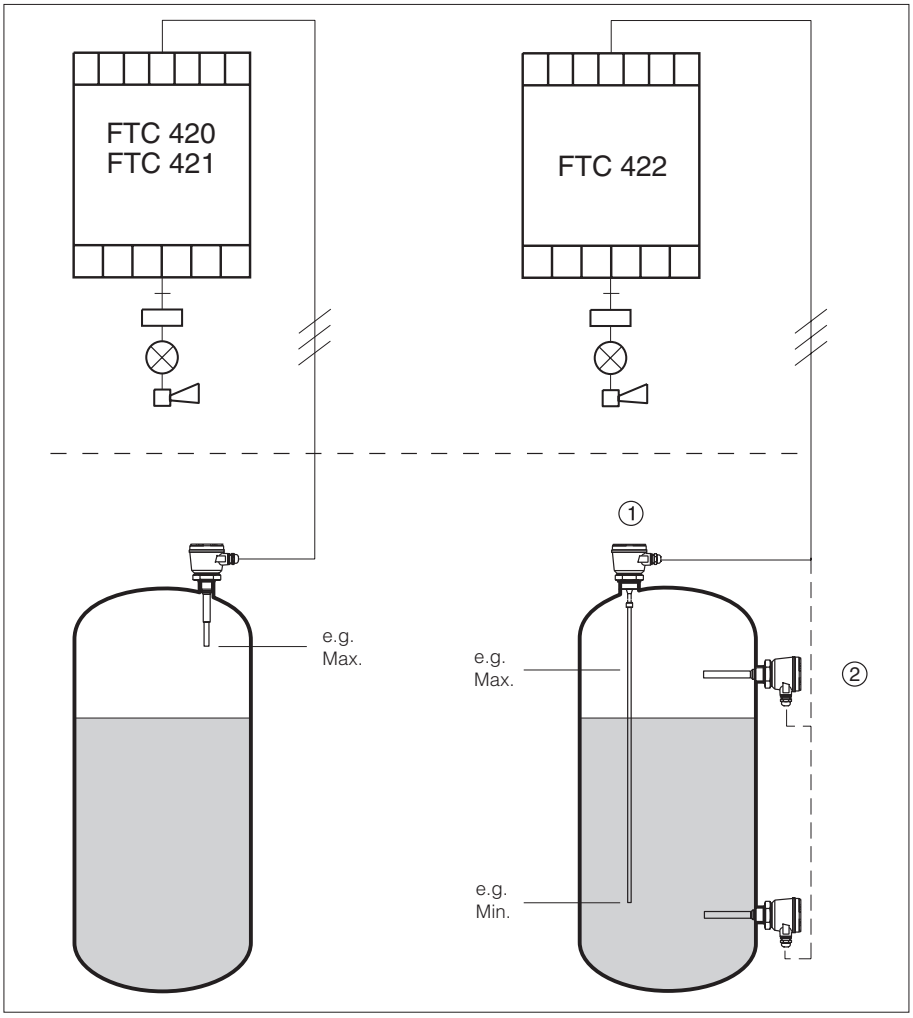
Measuring System

Function

The probe and container act as a capacitor, the capacitance of which is dependent upon the level of liquid or solids present.
The electronic insert, usually mounted in the probe head, passes a level-proportional voltage signal to the Nivotester for evaluation. This actuates the output relay when the preset level is violated. The resulting signal can be used to drive an annunciator, actuator or further relay.

A bridge on the terminal block sets the the output relay to act in minimum or maximum fail-safe mode.
The switching status of the relay is indicated at the front panel by a red, the operational status by a green LED. On power failure both LEDs extinguish – the output relay de-energises.



A typical measuring system comprises:
- the Nivotester FTC 420, 421 or 422
- the electronic insert EC 61 Z
- a probe, suitable for the medium to be measured (for FTC 422 one 1) or two 2) for two-point control)

Installation

Mounting
The Nivotester FTC 420...422 limit switches use Minipac housings with snap-on fastenings suitable for switch cabinet installation on a symmetrical (top hat) rail.

Spacing
The units can be mounted flush to each other provided the operating temperature does not exceed 50 °C. For ambient temperatures of 60 °C, a gap of 10 mm must be left between adjacent units.
The vertical spacing must exceed 15 mm.

Protective Housing IP 55
A protective housing with transparent cover, accommodating two units, is available for field installation.

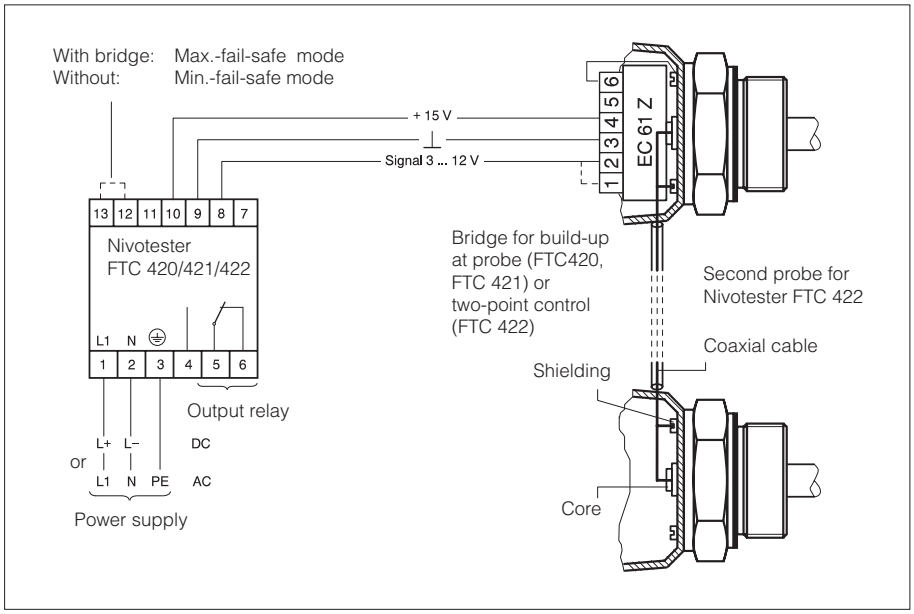
Row-mounting on a top hat rail

Protective housing IP 55

Electrical Connection
The Nivotester and electronic insert are connected by a 3-wire screened installation cable: two wires supply direct current to the insert, the third carries a voltage signal (3…12 V) proportional to the capacitance of the probe back to the unit.

The evaluation circuit is isolated from the power supply by a transformer and from the output circuit by a potential-free relay.

- A bridge can be inserted between terminals 1 and 2 of the electronic insert when there is a tendency for conductive build-up to form on the probe.
- The fail-safe mode is controlled by a bridge between terminals 12 and 13.
- The potential-free change-over contact is located at terminals 4, 5 and 6.



When the Nivotester FTC 422 is used with two probes, the second probe is used without electronic insert and the connection is made between probe ground and core via a coaxial cable. Terminals 1 and 2 of the insert are short-circuited.

Technical Data

CE Mark

The device fulfils the legal requirements of the following EC Guidelines:
Guideline 89/336/EC (Electromagnetic compatibility), Guidelines 73/23/EC and 93/68/EC (Low Voltage Appliances).

Electromagnetic compatibility (EMC): Immunity to EN 50082-1. Interference Emission to EN 61326, Electrical Equipment Class B Interference Immunity to EN 61326.

For general information on electromagnetic compatibility (test methods, installation hints) see TI 241F/00/en.

Mechanical
- Housing: Minipac housing in light grey plastic, front panel blue. Protection: IP 40
- Dimensions (l x b x h): 113 mm x 50 mm x 75 mm
- Weight: approx. 0.3 kg
- Mounting rail: EN 60715 TH-35x15 or EN 60715 TH-35x7.5

Ambient Temperature
- Permissible temperature: –20…+60 °C (single instrument), –20…+50 °C (multiple instruments), –25…+80 °C (storage).

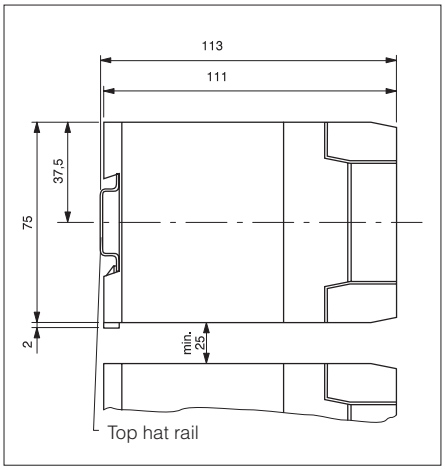
Electrical Connection
- Terminals: Removable terminal block, black, 1 x 6-pole, 1 x 7-pole, Protection: IP 20.
- Wire cross-section: 1 x 0.5 mm² to 1 x 2.5 mm² or 2 x 0.5 mm² to 2 x 1.5 mm².
- Without terminals: Flat plug 0.8 x 6.3 as per DIN 46244.
- Power supply:
  200 V…240 V 50/60 Hz +15%, –10%
  100 V…127 V 50/60 Hz +15%, –10%
  42 V… 48 V 50/60 Hz ±15 %
  24 V 50/60 Hz ±15 %
  20 V… 30 V DC
- Power consumption: approx. 3 W (4 VA).
- Electrical isolation: Transformer between power supply and evaluation circuit. Relay between evaluation circuit and output circuit.

Adjustable Probe Capacitance
- Hook switch

Range	Capacitance	Input voltage
I	approx. 10…100 pF	approx. 3…6.6 V
II	approx. 80…180 pF	approx. 6…8.8 V
III	approx. 160…350 pF	approx. 8.2…12 V

- Switching delay for FTC 421: 0…20 s.
- Hysteresis for FTC 422: Separate control, ranges as above.

EC 61 Z
electronic insert



Dimensions for cabinet mounting [mm]

Outputs
- Output signal: Potential-free change-over contact, selectable maximum or minimum fail-safe mode.
- Switching capacity: max. 250 V AC, max. 6 A, max. 1500 VA, cos φ = 1 max. 750 VA, cos φ ≥ 0.7, max. 250 V DC, max. 6 A, max. 200 W.
- Operational display: Green LED lights.
- Relay switching status: Red LED lights when de-energised.
- Response time: 0.2 s, for FTC 421 adjustable 0…20 s.
- Short-out time on power failure: approx. 0.3 s.

Electronic Insert
- Housing: Plastic, cast resin electronics, Protection: IP 55.
- Terminals: Protection: IP 00.
- Connection: 3-core screened cable.
- Permissible ambient temperature: –20…+100 °C.
- Frequency: approx. 500 kHz.
- Power supply: 15 V from Nivotester FTC.
- Output signal voltage: 3…12 V.
- Weight: 180 g

Protective Housing for FTC ...
- Base: ABS
- Front: Impact-resistant plexiglas, matt with transparent window, Protection: IP 55.
- Cable glands: 5 x PG 16.
- Dimensions (l x b x h): 124 mm x 160 mm x 164 mm.
- Weight: 0.5 kg.
- Permissible ambient temperature: –20…+50 °C; –20…+40 °C for two units.

Subject to modification.

Maximum and Minimum Fail-safe Mode

Nivotester FTC 420/421
This instrument can be set to operate as a maximum or a minimum limit switch. For the Nivotester FTC 421 the switching can be delayed by up 20 s, e.g. to prevent spurious switching due to turbulance etc..

Minimum fail-safe mode
The relay de-energises when the product drops below the switch point: the red LED lights.

Maximum fail-safe mode:
The relay de-energises when the switch point is exceeded: the red LED lights

Power failure
On a power failure both green and red LEDs extinguish: the relay de-energises.

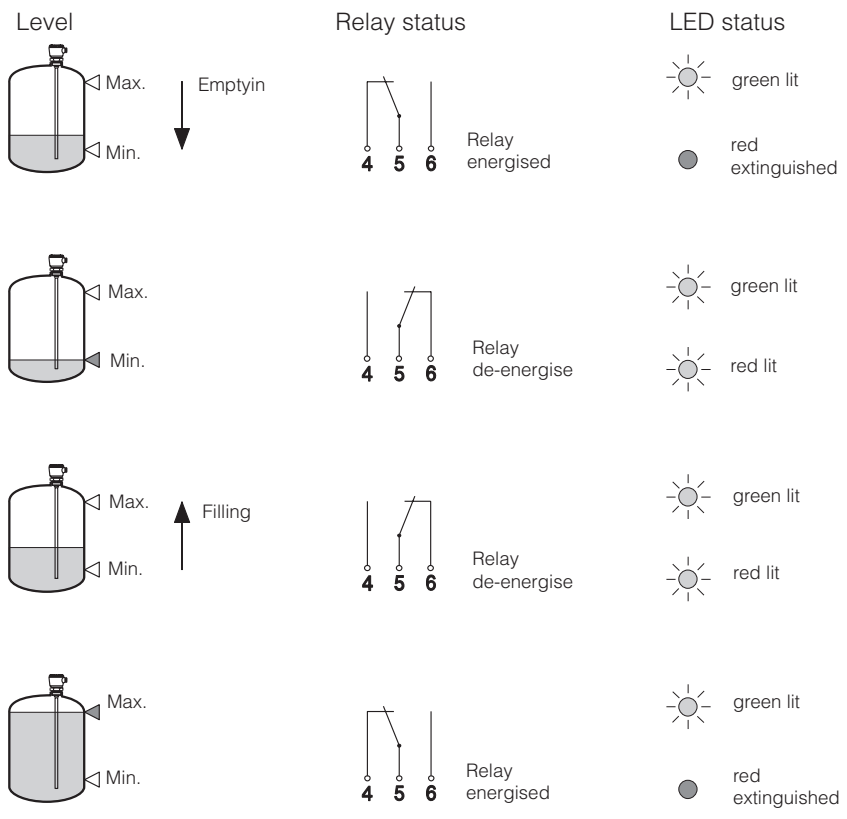
Nivotester FTC 422
This instrument provides two-point control with a maximum or minimum switch point and a switching differential (hysteresis).

Minimum fail-safe mode
The relay de-energises when the product drops below the switch point. The red LED lights and remains lit until the switching differential point is exceeded: the relay energises again.

Maximum fail-safe mode:
The relay de-energises when the switch point is exceeded. The red LED lights and remains lit until the product drops below the switching differential point: the relay energises again.

Power failure
On power failure both green and red LEDs extinguish: the relay de-energises.

Example for minimum fail-safe mode, FTC 422



When the Nivotester FTC 422 is used to control the filling or emptying of a vessel, the red relay status LED indicates that the level is rising or falling.

Ordering Information

Power Supply

A 220 V AC (230 V, +10%/–15%), 50/60 Hz
B 110 V AC, 50/60 Hz
C 48 V AC, 50/60 Hz
D 24 V AC, 50/60 Hz
E 21,5 V… 26,5 V DC
F 115 V AC, 50/60 Hz
G 127 V AC, 50/60 Hz
H 230 V AC, 50/60 Hz
J 240 V AC, 50/60 Hz
K 42 V AC, 50/60 Hz
Y Special voltage
↓

FTC 420 ☐

Power Supply

A 180 V…253 V AC
B 90 V…140 V AC
C 42 V… 48 V AC
D 24 V AC
E 20 V… 30 V DC
Y Special version
↓

FTC 421 ☐

Power Supply

A 180 V…253 V AC
B 90 V…140 V AC
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FTC 422 ☐

Supplementary Documentation

- ❑ Electronic Insert EC 61 Z
  Technical Information TI 267F/00/en
- ❑ System Components Minipac
  Technical Information TI 009F/00/en
- ❑ Separate housing for electronic insert
  Technical Information TI 228F/00/en

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